WHAT IS CLAIMED IS:

1. A method for extracting geologic faults from a 3-D seismic attribute cube, the method comprising:

calculating a minimum path value for each voxel of the 3-D seismic attribute cube;

extracting a fault network skeleton from the 3-D seismic attribute cube by utilizing the minimum path values which correspond to voxels within the 3-D seismic attribute cube;

flood filling the fault network to identify a plurality of fault segments, labeling the fault segments, and creating a vector description of the fault network skeleton;

subdividing the fault segments into individual fault patches wherein the individual fault patches are the smallest, non-intersecting, non-bifurcating patches that lie on only one geologic fault; and

correlating the individual fault patches into a representation of geologic faults.

2. The method according to Claim 1, wherein the step of calculating a minimum path value includes calculating a 3-D minimum path value.

3. The method according to Claim 1, wherein the step of calculating a minimum path further includes calculating the minimum path value of each voxel considering all routes from a pixel "P" to one of a plurality of termination pixels "T" which is equal to or greater than 4, and summing the values of all voxels along this route.

4. The method according to Claim 1, wherein the step of calculating a minimum path further includes calculating the minimum path value using a raster order for each of 16 predefined orientations.

5. The method according to Claim 1, wherein the step of calculating a minimum path further includes calculating the minimum path value using a reverse-raster order for each of 16 predefined orientations

6. The method according to Claim 1, further comprising applying a directional filter to the minimum path values to improve the connections between adjacent minimum path values.

7. The method according to Claim 1, further comprising performing a morphological top hat operation to create a top hat image.

8. The method according to Claim 7, further comprising a binarization of the top hat image utilizing a simple threshold.

9. The method according to Claim 8, further comprising extracting a plurality of extremities from the binarization of the top hat image.

10. The method according to Claim 9, further comprising skeletonizing the binarization of the top hat image, such that the skeleton passes through the extremities and through a highest values of the top hat image.

11. The method according to Claim 1, further comprising cleaning up the fault network skeleton using a pruning algorithm.

12. The method according to Claim 1, wherein the voxels which are on the fault skeleton are assigned a finding of "fault."

13. The method according to Claim 12, further comprising finding discrete grouping of voxels which were assigned a finding of "fault", that are mutually connected into fault segments.

14. The method according to Claim 1, further comprising determining an angle of an eigenvector of a variance-covariance matrix associated with a segment, and if the angle is within a pre-determined range, then maintaining the segment as a single patch, and if the angle outside the pre-determined range then subdividing the segment into at least two fault patches.

15. The method according to Claim 1, wherein the step of subdividing further comprises utilizing an adjacency list to merge a plurality of fault patches which have voxels in common.

16. The method according to Claim 1, further comprising determining a vector description of the fault network by determining an angle of an eigenvector of a variance-covariance matrix associated with connected segments, and if an angular difference is within a pre-determined range, then maintaining the segments as a single patch, and if the angular difference is outside the pre-determined range then subdividing the segment into at least two fault patches with their associated eigenvectors.

17. The method according to Claim 1, wherein the step of labeling further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice.

18. The method according to Claim 1, wherein the step of subdividing further comprises calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

19. The method according to Claim 1, wherein the step of subdividing further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice, and calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

20. The method according to Claim 18, wherein the step of calculating includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch fragment, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault fragments into a fault patch.

21. The method according to Claim 19, wherein the step of constructing includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch fragment, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault fragments into a fault patch.

22. The method according to Claim 1, further comprising correlating the individual fault patches into realistic representations of geologic faults in a manual or semi-manual approach.

23. The method according to Claim 22, wherein the step of correlating further includes manually rotating a view and selecting the individual fault patches to be assigned to a fault.

24. The method according to Claim 22, wherein a user views the individual fault patches by manually rotating and interactively selecting correlated patches while iterating on an acceptable distance to an object.

25. The method according to Claim 22, further comprising reorienting a view direction directly down the dip direction of the individual fault patches, digitizing a trace of the fault along a time slice, and dropping a fault surface in the direction of the view.

26. The method according to Claim 1, further comprising correlating the individual fault patches into realistic representations of geologic faults in an automatic approach.

27. The method according to Claim 26, further comprising automatically correlating associated adjacent individual fault patches that fit a geometric criteria of co-planarity based on the selected parameters of minimum distance and angles between the patches.

28. The method according to Claim 26, further comprising a pre-processing step using a fast scan of all individual fault patches to determine whether or not two individual fault patches are close to each other for further consideration.

29. A method for extracting geologic faults from a 3-D seismic attribute cube, the method comprising:

calculating a minimum path value for each voxel of the 3-D seismic attribute cube;

extracting a fault network skeleton from the 3-D seismic attribute cube by utilizing the minimum path values which correspond to voxels within the 3-D seismic attribute cube;

flood filling the fault network to identify a plurality of fault segments, labeling the fault segments, and creating a vector description of the fault network skeleton;

subdividing the fault network skeleton into individual fault patches; and

correlating the individual fault patches into a representation of geologic faults.

30. A method for extracting faults from a 3-D seismic attribute cube, the method comprising:

reading a composite fault fragment into a 3-D lattice of finite size into a computer memory; and

constructing a best-fit plane from adjacent connected points within the 3-D lattice.

31. A method of correlating individual fault patches into realistic representations of geologic faults comprising:

scanning individual fault patches to determine whether two individual fault patches are close to each other for further evaluation; and

if the individual fault patches are determined to be close, then automatically correlating associated adjacent individual fault patches that fit a geometric criteria of co-planarity based on pre-determined parameters of minimum distance and angles between the patches.

32. The method according to Claim 31, wherein the pre-determined parameters are selected by visually evaluating the individual fault patches.

33. The method according to Claim 31, wherein patches are visually displayed and are iteratively correlated to provide an improved geologic fault representation.

34. A method for extracting faults from a 3-D seismic attribute cube, the method comprising:

calculating a 3-D minimum path value for each voxel of the 3-D seismic attribute cube; and

combining the 3-D minimum path value at each voxel with the 3-D seismic attribute cube to extract a fault network skeleton.

35. A method of subdividing a fault segment comprising

flood filling a fault network to identify a plurality of fault segments, labeling the fault segments, and creating a vector description of the fault segments; and

subdividing the fault segments to create the smallest, non-intersecting, non-bifurcating patches that lie on only one geologic fault.

36. The method according to Claim 35, wherein the step of labeling further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice.

37. The method according to Claim 35, wherein the step of subdividing further comprises calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

38. The method according to Claim 35, wherein the step of subdividing further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice, and calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

39. The method according to Claim 37, wherein the step of calculating includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault patches.

40. The method according to Claim 38, wherein the step of constructing includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch fragment, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault fragments into a fault patch.

41. A method of identifying fault segments from a fault network comprising:

providing a fault network having a plurality of fault segments;

using an adjacency list to merging fault patch fragments which contain voxels in common;

labeling the fault segments; and

creating a vector description of the fault segments.

42. The method according to Claim 41, further comprises finding discrete grouping of voxels which were assigned a finding of "fault", that are mutually connected into fault segments.

43. The method according to Claim 41, wherein the step of creating further includes determining an angle of an eigenvector of a variance-covariance matrix associated with a segment, and if the angle is within a pre-determined range, then maintaining the segment as a single patch, and if the angle outside the pre-determined range then subdividing the segment into at least two fault patches.

44. The method according to Claim 41, wherein the step of labeling further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice.

45. A computer-readable medium containing executable code for extracting geologic faults from a 3-D seismic attribute cube, which when executed performs procedures of:

calculating a minimum path value for each voxel of the 3-D seismic attribute cube;

extracting a fault network skeleton from the 3-D seismic attribute cube by utilizing the minimum path values which correspond to voxels within the 3-D seismic attribute cube;

flood filling the fault network to identify a plurality of fault segments, labeling the fault segments, and creating a vector description of the fault network skeleton;

subdividing the fault segments into individual fault patches wherein the individual fault patches are the smallest, non-intersecting, non-bifurcating patches that lie on only one geologic fault; and

correlating the individual fault patches into a representation of geologic faults.

46. The computer-readable medium containing executable code according to Claim 45, wherein the step of calculating a minimum path value includes calculating a 3-D minimum path value.

47. The computer-readable medium containing executable code according to Claim 45, wherein the step of calculating a minimum path further includes calculating the minimum path value of each voxel considering all routes from a pixel "P" to one of a plurality of termination pixels "T" which is equal to or greater than 4, and summing the values of all voxels along this route.

48. The computer-readable medium containing executable code according to Claim 45, wherein the step of calculating a minimum path further includes calculating the minimum path value using a raster order for each of 16 predefined orientations.

49. The computer-readable medium containing executable code according to Claim 45, wherein the step of calculating a minimum path further includes calculating the minimum path value using a reverse-raster order for each of 16 predefined orientations

50. The computer-readable medium containing executable code according to Claim 45, further comprising applying a directional filter to the minimum path values to improve the connections between adjacent minimum path values.

51. The computer-readable medium containing executable code according to Claim 45, further comprising performing a morphological top hat operation to create a top hat image.

52. The computer-readable medium containing executable code according to Claim 51, further comprising a binarization of the top hat image utilizing a simple threshold.

53. The computer-readable medium containing executable code according to Claim 52, further comprising extracting a plurality of extremities from the binarization of the top hat image.

54. The computer-readable medium containing executable code according to Claim 53, further comprising skeletonizing the binarization of the top hat image, such that the skeleton passes through the extremities and through a highest values of the top hat image.

55. The computer-readable medium containing executable code according to Claim 45, further comprising cleaning up the fault network skeleton using a pruning algorithm.

56. The computer-readable medium containing executable code according to Claim 45, wherein the voxels which are on the fault skeleton are assigned a finding of "fault."

57. The computer-readable medium containing executable code according to Claim 56, further comprising finding discrete grouping of voxels which were assigned a finding of "fault", that are mutually connected into fault segments.

58. The computer-readable medium containing executable code according to Claim 45, further comprising determining an angle of an eigenvector of a variance-covariance matrix associated with a segment, and if the angle is within a pre-determined range, then maintaining the segment as a single patch, and if the angle outside the pre-determined range then subdividing the segment into at least two fault patches.

59. The computer-readable medium containing executable code according to Claim 45, wherein the step of subdividing further comprises utilizing an adjacency list to merge a plurality of fault patches which have voxels in common.

60. The computer-readable medium containing executable code according to Claim 45, further comprising determining a vector description of the fault network by determining an angle of an eigenvector of a variance-covariance matrix associated with connected segments, and if an angular difference is within a pre-determined range, then maintaining the segments as a single patch, and if the angular difference is outside the pre-determined range then subdividing the segment into at least two fault patches with their associated eigenvectors.

61. The computer-readable medium containing executable code according to Claim 45, further comprising determining a vector description of the fault network by determining an angle of an eigenvector of a variance-covariance matrix associated with connected segments, and if the angular difference is within a pre-determined range, then maintaining the segments as a single patch, and if the angular difference is outside the pre-determined range then labeling the segment into at least two fault patches with their associated eigenvectors.

62. The computer-readable medium containing executable code according to Claim 45, wherein the step of subdividing further comprises calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

63. The computer-readable medium containing executable code according to Claim 45, wherein the step of subdividing further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice, and calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

64. The computer-readable medium containing executable code according to Claim 62, wherein the step of calculating includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch fragment, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault fragments into a fault patch.

65. The computer-readable medium containing executable code according to Claim 63, wherein the step of constructing includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch fragment, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault fragments into a fault patch.

66. The computer-readable medium containing executable code according to Claim 45, further comprising correlating the individual fault patches into realistic representations of geologic faults in a manual or semi-manual approach.

67. The computer-readable medium containing executable code according to Claim 66, wherein the step of correlating further includes manually rotating a view and selecting the individual fault patches to be assigned to a fault.

68. The computer-readable medium containing executable code according to Claim 66, wherein a user views the individual fault patches by manually rotating and interactively selecting correlated patches while iterating on an acceptable distance to an object.

69. The computer-readable medium containing executable code according to Claim 66, further comprising reorienting a view direction directly down the dip direction of the individual fault patches, digitizing a trace of the fault along a time slice, and dropping a fault surface in the direction of the view.

70. The computer-readable medium containing executable code according to Claim 45, further comprising correlating the individual fault patches into realistic representations of geologic faults in an automatic approach.

71. The computer-readable medium containing executable code according to Claim 70, further comprising automatically correlating associated adjacent individual fault patches that fit a geometric criteria of co-planarity based on the selected parameters of minimum distance and angles between the patches.

72. The computer-readable medium containing executable code according to Claim 70, further comprising a pre-processing step using a fast scan of all individual fault patches to determine whether or not two individual fault patches are close to each other for further consideration.

73. A computer-readable medium containing executable code for extracting geologic faults from a 3-D seismic attribute cube, which when executed performs procedures of:

calculating a minimum path value for each voxel of the 3-D seismic attribute cube;

extracting a fault network skeleton from the 3-D seismic attribute cube by utilizing the minimum path values which correspond to voxels within the 3-D seismic attribute cube;

flood filling the fault network to identify a plurality of fault segments, labeling the fault segments, and creating a vector description of the fault network skeleton;

subdividing the fault network skeleton into individual fault patches; and

correlating the individual fault patches into a representation of geologic faults.

74. A computer-readable medium containing executable code for extracting faults from a 3-D seismic attribute cube, which when executed performs procedures of:

reading a composite fault fragment into a 3-D lattice of finite size into a computer memory; and

constructing a best-fit plane from adjacent connected points within the 3-D lattice.

75. A computer-readable medium containing executable code of correlating individual fault patches into realistic representations of geologic faults which when executed performs procedures of:

scanning individual fault patches to determine whether two individual fault patches are close to each other for further evaluation; and

if the individual fault patches are determined to be close, then automatically correlating associated adjacent individual fault patches that fit a geometric criteria of co-planarity based on pre-determined parameters of minimum distance and angles between the patches.

76. The computer-readable medium containing executable code according to Claim 75, wherein the pre-determined parameters are selected by visually evaluating the individual fault patches.

77. The computer-readable medium containing executable code according to Claim 75, wherein patches are visually displayed and are iteratively correlated to provide an improved geologic fault representation.

78. A computer-readable medium containing executable code for extracting faults from a 3-D seismic attribute cube, which when executed performs procedures of:

calculating a 3-D minimum path value for each voxel of the 3-D seismic attribute cube; and

combining the 3-D minimum path value at each voxel with the 3-D seismic attribute cube to extract a fault network skeleton.

79. A computer-readable medium containing executable code of subdividing a fault segment which when executed performs procedures of:

flood filling a fault network to identify a plurality of fault segments, labeling the fault segments, and creating a vector description of the fault segments; and

subdividing the fault segments to create the smallest, non-intersecting, non-bifurcating patches that lie on only one geologic fault.

80. The computer-readable medium containing executable code according to Claim 79, wherein the step of labeling further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice.

81. The computer-readable medium containing executable code according to Claim 79, wherein the step of subdividing further comprises calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

82. The computer-readable medium containing executable code according to Claim 79, wherein the step of subdividing further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice, and calculating a normal to a best-fit plane for each voxel on a fault patch fragment in a 3-D lattice.

83. The computer-readable medium containing executable code according to Claim 81, wherein the step of calculating includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault patches.

84. The computer-readable medium containing executable code according to Claim 82, wherein the step of constructing includes comparing the normal best-fit plane between each adjacent voxel that lies on a fault patch fragment, and identifying the normal best-fit planes which are within the user-supplied limit, and merging similarly oriented fault fragments into a fault patch.

85. A computer-readable medium containing executable code of identifying fault segments from a fault network which when executed performs procedures of:

providing a fault network having a plurality of fault segments;

using an adjacency list to merging fault patch fragments which contain voxels in common;

labeling the fault segments; and

creating a vector description of the fault segments.

86. The computer-readable medium containing executable code according to Claim 85, further comprises finding discrete grouping of voxels which were assigned a finding of "fault", that are mutually connected into fault segments.

87. The computer-readable medium containing executable code according to Claim 85, wherein the step of creating further includes determining an angle of an eigenvector of a variance-covariance matrix associated with a segment, and if the angle is within a pre-determined range, then maintaining the segment as a single patch, and if the angle outside the pre-determined range then subdividing the segment into at least two fault patches.

88. The computer-readable medium containing executable code according to Claim 85, wherein the step of labeling further comprises constructing a best-fit plane from adjacent connected points within a 3-D lattice.